Introduction

Kuipers, Theo A.F.

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INTRODUCTION

When Karl Popper published in 1963[1] his definition of closer-to-the-truth this was an important intellectual event, but not a shocking one. Everybody could react by saying that the definition was as it should be, and even that it could have been expected. For plausible the definition was indeed: a theory is closer to the truth than another one if the first has more true and less false consequences than the second.

About ten years later the 1963 event became shocking with retrospective effect when David Miller[2] and Pavel Tichý[3] independently proved that a false theory, that is a theory with at least one false consequence, could according to Popper's definition never be closer to the truth than another one.[4]

With this proof they demolished the definition, for it could not do justice to the presupposed nature of most of the culminating-points in the history of science: new theories, such as Einstein's theory, though presumably false, are more successful than their predecessors, such as Newton's theory, just because they are closer to the truth, that is, closer to the unknown true theory about the subject matter.

Miller and Tichý unchained with their proof in the beginning beside signs of deception mainly sceptical remarks like "only the intuïtive idea is important, fortunately", "it shows that you can't solve philosophical problems by formal means" and last but not least "it is the punishment for speaking freely about *the* truth".

However, after some time Miller, Tichý and other philosophers recovered from the fright and started to develop alternative definitions of closer-to-the-truth. The result anno 1986 is that there are at least four formal approaches to verisimilitude or truthlikeness, to use the two current names for the problem area. All four of them are presented in this volume and later in this introduction there will be given short impressions of these contributions. Here it suffices to make only some very general remarks.

To begin with, all four approaches have in common that 'the truth' about a certain part or aspect of reality is at the one hand determined by the previously chosen conceptual means, hence there is no question of metaphysical truth, and within these conceptual boundaries it is determined by the nature of reality itself. This form of 'realism' is highly defensible for the natural sciences and certainly less defensible for the social sciences.

With some qualifications one can say that three of the four approaches are primarily *syntactic*. Niiniluoto's likeness or *similarity* approach, as far as cognitive problems defined through a language are concerned, centers around the syntactic similarities and dissimilarities between the relevant potential answers to the problem. The approach byTichý and Oddie, here presented and deepened by Oddie, is related to that of Niiniluoto, it is pre-eminently a syntactic similarity approach, but it differs in essential aspects, leading to Wittgensteinian *pictures of the world* claims.

The third syntactic approach, due to Schurz and Weingartner, is here presented for the first time. It is a reanimation of Popper's original *consequence* approach by restricting the definition of closer-to-the-truth to the *reduced relevant* consequences, a notion that was earlier shown by the authors to be useful in other areas.

There are at least two variants of the fourth, *semantic* approach. The first one was published by Miller who identified, in the same spirit as the syntactic approaches, 'the truth' with the truth about the actual world. Kuipers distinguishes between this so-called descriptive truth and the *theoretical* truth, and started his research with a Miller-like definition of theoretical truthlikeness. Unfortunately, the present volume only contains an exposition, by Kuipers, of this second variant of the semantic approach.

Beside the four approach papers, the present volume contains eight further contributions. Like the approach papers, these other contributions will be summarized in some detail later on. Three of them are new elaborations of those three approaches that have been published earlier. The five other contributions present global and local criticism of these approaches and of some informal approaches known in the literature. Moreover, they draw attention to new aspects and new points of view. As far as mutual criticism is concerned it should be stressed that the criticism is based on earlier publications except when there is explicit cross reference to contributions in this volume.

The approach papers

In his first paper *Niiniluoto* gives a concise summary of the basic ideas of the similarity approach to truthlikeness. Verisimilitude is regarded as a quantitative concept, admitting degrees, which can be used for ordering the rival answers to a cognitive problem. The key in the definition is a distance function Δ, which expresses the dissimilarity of the complete answers to the cognitive problem. Then the degree of truthlikeness of a particular answer is defined as a weighted combination of two factors which reflect our cognitive interests in hitting close to the truth and excluding false alternatives. Formally, this degree depends on the distance

of the answer from the target sentence, defined as the most informative true statement in the language of the problem situation. When the target is unknown, truthlikeness can be estimated on evidence by calculating expected degrees of verisimilitude relative to an epistemic probability measure.

Oddie motivates in his article a particular proposal within the similarity or likeness approach by invoking some suggestive features of a picture theory of statements. It is argued that the constituents of suitably interpreted languages are pictures or models of the structures which they pick out. Given this, a measure of distance between constituents which exploits their syntactic structure can be used to glean a measure of distance between the structures they pick out. The account involves a resuscitation of some features of logical atomism. While this may seem unduly restrictive, in fact it is shown how such an account can be extended to higher-order intensional systems much more powerful than the first-order systems usually treated of by logicians. Such useful notions as closeness to truth about natural necessity (legisimilitude) and question-answering accuracy fall out of the account as a bonus.

According to Popper's original idea of verisimilitude, a theory is the nearer to the truth the more true and the less false consequences it has. This *consequence-approach* to verisimilitude is very close to our philosophical intuitions as well as to the practice of scientific progress. But as said already, Popper's respective definition of his idea has led into seemingly unsolvable problems, as Tichý, Miller and others have shown. *Schurz and Weingartner* show in their paper that these problems can be solved by restricting the classical consequence-class with the help of two operations: First, they take only the *relevant consequences* — according to a certain logical criterion of relevant deduction. Thus they eliminate irrelevant consequences. Second, they decompose every relevant consequence into its *irreducible conjunctive elements*. Thus they eliminate redundant consequences. By applying these two restriction principles they obtain the so-called class of *relevant consequence-elements*. Dividing this class into its true and its false parts leads to a definition of a comparative notion of verisimilitude quite analogous to Popper's original definition. They show that the new definition of verisimilitude blocks the counterarguments of Tichý and Miller against Popper because they rest either on irrelevant or on redundant consequences. Furthermore they show with the help of some theorems and some applications to theories of propositional and first order predicate language that the new definition leads to intuitively satisfying results. Finally they give a sketch of applications to some examples of real scientific theories and of possible extensions of their approach.

According to Miller and Kuipers the appropriate category for defining truthlikeness is not the category of sentences but that of (sets of) models of sentences or, more generally, structures and sets of structures. Essentially in the same spirit as the syntactic approaches, Miller conceived, in his modeltheoretic definition of truthlikeness, 'the truth' as the one structure representing the actual world. In contrast to this, Kuipers distinguishes between this so-called 'descriptive truth' and 'the theoretical truth', i.e. the set of structures representing the set of empirical possibilities.

In his approach paper *Kuipers* presents his earlier, Miller-like, definition of 'theoretical truthlikeness', and extends it to the case that there is a non-trivial underlying notion of 'descriptive truthlikeness' or, more generally, structurelikeness, accounting for the fact that in actual science structures are not only right or wrong in representing some actual state of affairs, but a wrong one may or may not be a better approximation of the right one than a third one. Moreover, the forementioned, naive and sophisticated, comparative notions of theoretical truthlikeness are extended to plausible quantitative versions.

The other contributions

Van Benthem discusses in his contribution the possible analogies between the notion of verisimilitude and that of conditionals. After rejecting the possibility of a global reduction in either direction, he shows among others that general semantic viewpoints concerning conditionals can be applied to verisimilitude, leading to a more systematic chart of possible explications for this notion, in particular of the semantic ones. Conversely, he shows that and how it is possible to inject notions of verisimilitude into existing conditional semantics.

According to *Cohen* verisimilitude and legisimilitude are mutually complementary objectives for scientific enquiry, including the pursuit of laws that hold only under ideal conditions. But it is knowledge, i.e. justified true belief, that is sought, not just truth, and one has to distinguish between the aim to accumulate more known items and the aim to increase the reliability of one's knowledge. Knowledge of counterfactuals is a contribution to legisimilitude not verisimilitude, because legisimilitude is not to be identified with causual verisimilitude. Legisimilitude, unlike verisimilitude, flows down from a hypothesis to its consequences, and rejection of this relationship leads to the paradox of allowing the conjunction of two laws to explain its conjuncts. It is also worth noticing that this relationship ensures an incompatibility between phenomenalist analyses of scientific theory, on the one side, and respect for legisimilitude, on the other.

A main idea underlying the paper of *Festa* is that many controversial

questions in verisimilitude theory can be better faced starting from a clear formal explication of the general concept of similarity. He proposes an explication of the notion of 'similarity between kinds of objects' and shows that it can be used to define the concept of similarity between —and verisimilitude of — hypotheses.

Firstly, comparative and quantitative notions of similarity applicable to the kinds of objects described in a monadic predicate language are defined. Secondly, these notions are applied to the definition of several concepts: (1) the similarity and verisimilitude of *singular hypotheses* of a monadic language, (2) the similarity between *kinds of worlds* described on the basis of monadic languages, and (3) the similarity and verisimilitude of *constituents* of monadic languages. Thirdly, the concept of similarity between kinds of objects is used to deal with the so-called 'problem of theoretical verisimilitude'. Lastly, the present similarity approach is used to identify a number of 'hidden assumptions' underlying some current theories of verisimilitude.

In his second contribution *Kuipers* extends his analysis of comparative theoretical truthlikeness to the situation that the theories to be compared have a theoretical and a, relatively, non-theoretical level. It turns out that the methodologically relevant back- and forward properties of the unstratified case can be supplemented by equally relevant down- and upward theorems. Finally, he argues that his analysis of the epistemologically stratified case is more general than it might seem at first sight.

In his second contribution *Niiniluoto* applies the similarity approach to truthlikeness for the case, where truth is indefinite. This situation may arise from the semantic vagueness of the relevant language, or from the fact that the world itself is indeterminate relative to a sharply defined language (e.g., a language with real-valued quantities). The actual world has then to be represented by a class of structures, and the target of the cognitive problem is a disjunction. This idea is studied here in the special case of singular sentences relative to a quantitative state space. In particular, it is shown that indeterminate statements without truthvalue have nevertheless well-defined degrees of truthlikeness.

Oddie starts his second contribution by stressing that the Popperian programme for truthlikeness is a tempting one: what counts in favour of the truthlikeness of a proposition is the total quantity of truths which it implies; what counts against, the total quantity of falsehoods it implies. Various attempts to articulate this simple idea have failed. The proof of the Tichý-Miller result does, however, suggest that Popper's content approach might be amended by placing some restriction on the consequences which are allowed to count for or against truthlikeness. Atomic, or elementary propositions are natural candidates. However, according to Oddie, it turns

out that the content account so modified works best for complete propositions, or constituents, and that to secure the right orderings generally it is necessary to switch to the alternative approach, based on likeness between worlds, or their surrogates, constituents. An apparently different restriction, that of convexity, concedes much to the similarity approach at the outset, in as much as it utilises essentially the same apparatus of distances or likeness between worlds. Moreover, as Oddie argues, given certain plausible assumptions, it follows that a proposition is convex just in case it is the conjunction of some elementary propositions. As a consequence the atomic-content approach, and the convex-content approach collapse into each other. The arguments that lead away from the atomic-content approach, also lead away from the convex-content approach. Furthermore, Oddie explains that any misgivings about the metaphysical presuppositions of a similarity approach based on atomicity apply equally to a content approach based on convexity.

In the face of the logical objections that have been unearthed against earlier attempts to defend a realist theory of science in the past, W.H. Newton-Smith has forwarded the *Thesis of verisimilitude* as an *explanatory hypothesis* to account for the observational successes of modern scientific theories. In his paper *De Vries* reviews Newton-Smith's argumentation in detail and argues that it fails. To use the concept of verisimilitude in an explanation, it has to be relativized to some theory which — for the time being — is accepted as a standard for truth. However, this move changes 'verisimilitude' from being a semantic concept into an epistemic one and therefore contradicts the basic idea of realism, that the truth and verisimilitude of our theories depend on the state of the world, rather than on the coherence of our beliefs.

A heuristically more fruitful way to explain the observational successes of modern science, De Vries argues, may be derived from L. Fleck's relativist view of science. In this view, the development of scientific knowledge is perceived as a process of *mutually* tuning theory and reality. It suggests that the observational successes of science may be explained in a sociological way, by focusing on the specific selection procedures embodied in the organization and practices of scientific communities.

Finally, *Zandvoort* starts his contribution by drawing attention to the fact that Popper, when he introduced his idea of verisimilitude, he claimed that "[his] theory of testability or corroboration by empirical tests is the proper methodological counterpart to this new metalogical idea". With this he seemed to imply that his "three requirements for the growth of knowledge" while giving a concise summary of his methodological ideas, can be given a justification in terms of the newly introduced concept, under the assumption that science aims at getting closer to the truth.

Using Kuipers's explication of (theoretical) verisimilitude, Zandvoort argues that especially for the second and third of Popper's requirements, which in conjunction come down to the requirement that a new theory must successfully *predict novel facts*, an underpinning of the kind envisioned by Popper can as yet not be provided, and that moreover the prospects for doing so are not good at all. This is in spite of the fact that *historically* speaking these two requirements *do* seem to be correct.

Coming back to the beginning of this introduction, there was suggested an external condition of adequacy for definitions of closer-to-the-truth, namely that it should not only leave room for false theories being closer to the truth, but that it should also explain the eventual extra empirical success of (false) new theories in terms of being closer to the truth, which might be called Laudan's challenge[5]. The present volume is primarily directed to internal considerations of truthlikeness, but all four approaches for instance claim, explicitly or implicitly, that this external challenge can be accepted, as far as it is reasonable. However, the actual competition between the four approaches on this external point has still to begin, and can begin on the basis of this volume. More generally, the methodological impact and comparison of truthlikeness theories, that is "how to approach the truth?" is the natural question to raise after "what is closer-to-the-truth?"

Groningen, September 1986 T.K.

Notes

1. K.R. Popper, *Conjectures and Refutations*, Routledge and Kegan Paul, London, 1963, Ch. 10.
2. D. Miller, "Popper's qualitative theory of verisimilitude", *The British Journal for the Philosophy of Science* 25, 1974, 166-177.
3. P. Tichý, "On Popper's definitions of verisimilitude", *The British Journal for the Philosophy of Science* 25, 1974, 155-160.
4. The paper by Schurz and Weingartner in this volume contains (Section 1.2) a reproduction of Tichý's inadequacy proof.
5. L. Laudan, "A confutation of convergent realism", *Philosophy of Science* 48.1.1981, 19-49.